Data Repository/Supplemental Data File for Late Drainage Along Portions of Samara Valles

- PowerPoint file includes locations of the selected eight profiles with MOLA shot points and data used for estimating channel width and depth.
- Calculations of discharge using the above estimates for each profile after methods described in Wilson et al., 2004 as slightly modified by Mangold et al., 2021.

Depth and width estimation

- Channel width, W, was estimated along eight profiles that were approximately perpendicular to channel margins identified by locations where morphology (e.g., lowermost occurring putative depositional forms or terraces) and MOLA shot points indicate a transition to lower, intervening elevations.
- The elevation of the channel margins and floors were estimated by averaging selected MOLA shot points on the channel that are located as close to the selected profiles as possible. The difference in elevation between the channel margin and channel floor was used to estimate the average channel depth, H.
- Using these estimated channel widths and depths for each profile, we assumed both rectangular and triangular channel cross sections. The average depth and width were used to estimate the cross-sectional area, A to estimate the hydraulic radius, R using equation (A1) for rectangular channel cross sections and (A2) for triangular channel cross sections.
- (A1) $R = \frac{A}{W+2H}$
- (A2) $R = \frac{\frac{1}{2}A}{W+2H}$
- The channel gradients (slope, S) were estimated using the elevation difference between two individual MOLA shot points located along the central valley floor divided by the measured intervening distance between them along the channel.

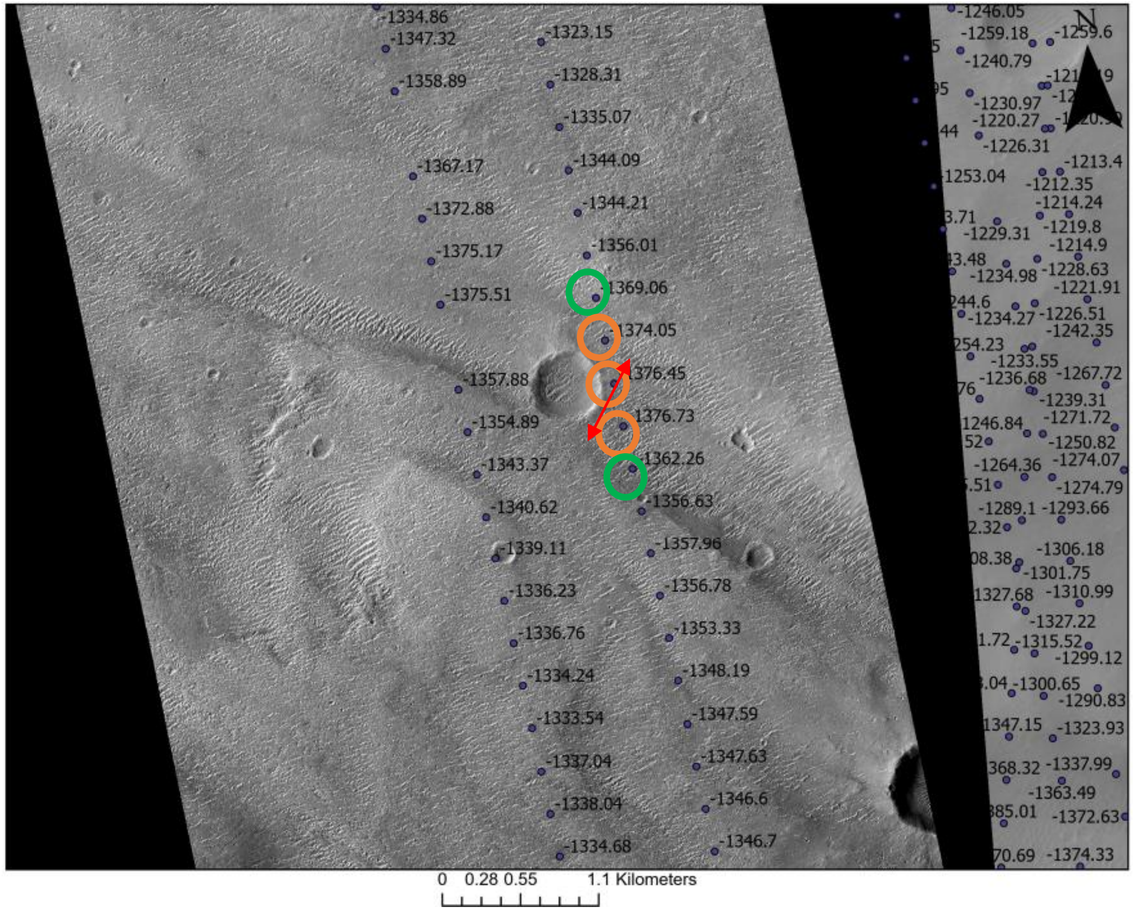
Friction factor and velocity estimation

- For the friction factor (f_c) values used in velocity estimations, we used predictors for a sand bed using equation (A3), gravel bed using equation (A4), boulder bed using equation (A5), and an upper regime sand bed using equation (A6) (equations 13-15 and 7b in Wilson et al., (2004), see also Kleinhans, 2005).
- (A3) Sand Bed $({}^{8}/{}_{f_c})^{\frac{1}{2}} = 8.46({}^{R}/{}_{D_{50}})^{0.1005}$
- (A4) Gravel Bed $({}^{8}/{}_{f_c})^{\frac{1}{2}} = 5.75\log_{10}({}^{R}/{}_{D_{84}}) + 3.514$
- (A5) Boulder Bed $({}^{8}/{}_{f_c})^{\frac{1}{2}} = 5.62\log_{10}({}^{R}/{}_{D_{84}}) + 4.0$
- (A6) Upper regime $({}^{8}/{}_{f_c})^{\frac{1}{2}} = 7.515({}^{R}/{}_{D_{50}})^{0.1005}\,S^{-0.03953}\sigma_g{}^{-0.1283}$
- The values for D84, D50, and σ_g used in the computation of friction factor under different channel bed and flow conditions were obtained from the mean values presented in Table 1 of Wilson et al., (2004) due to a lack of in situ data.
- $D_{50} = 0.064$
- $D_{84} = 0.164$
- $\sigma_g = 2.9$
- In terms of the Darcy-Weisbach equation in equation (4) in Wilson et al., (2004), we use equation (A7) to estimate the velocity of each friction factor under different channel bed and flow conditions for each profile.
- (A7) $U_C = (8gRS/f_c)^{\frac{1}{2}}$
- We use gravitational acceleration from Mangold et al., (2021) where,
- $g_{Mars} = 3.72\ ms^{-2}$

Discharge estimation

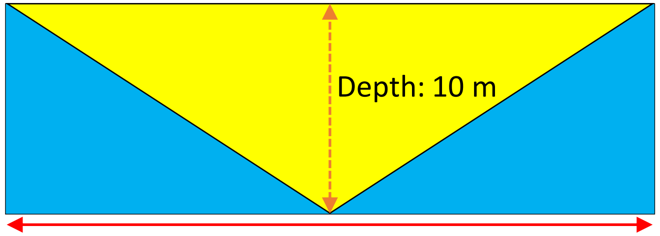
- We use the modified equation (1) in Wilson et al., (2004), which Mangold et al., (2021) also used in their equation (S1), to estimate the discharge, Q, values using equation (A8) for assumed rectangular channel cross sections and equation (A9) for triangular channel cross sections.
- $(A8) Q = A(\frac{8gRS}{f_c})^{0.5}$
- $(A9) Q = \frac{1}{2} A(\frac{8gRS}{f_c})^{0.5}$

Profile 1
ESP_073085_1595



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

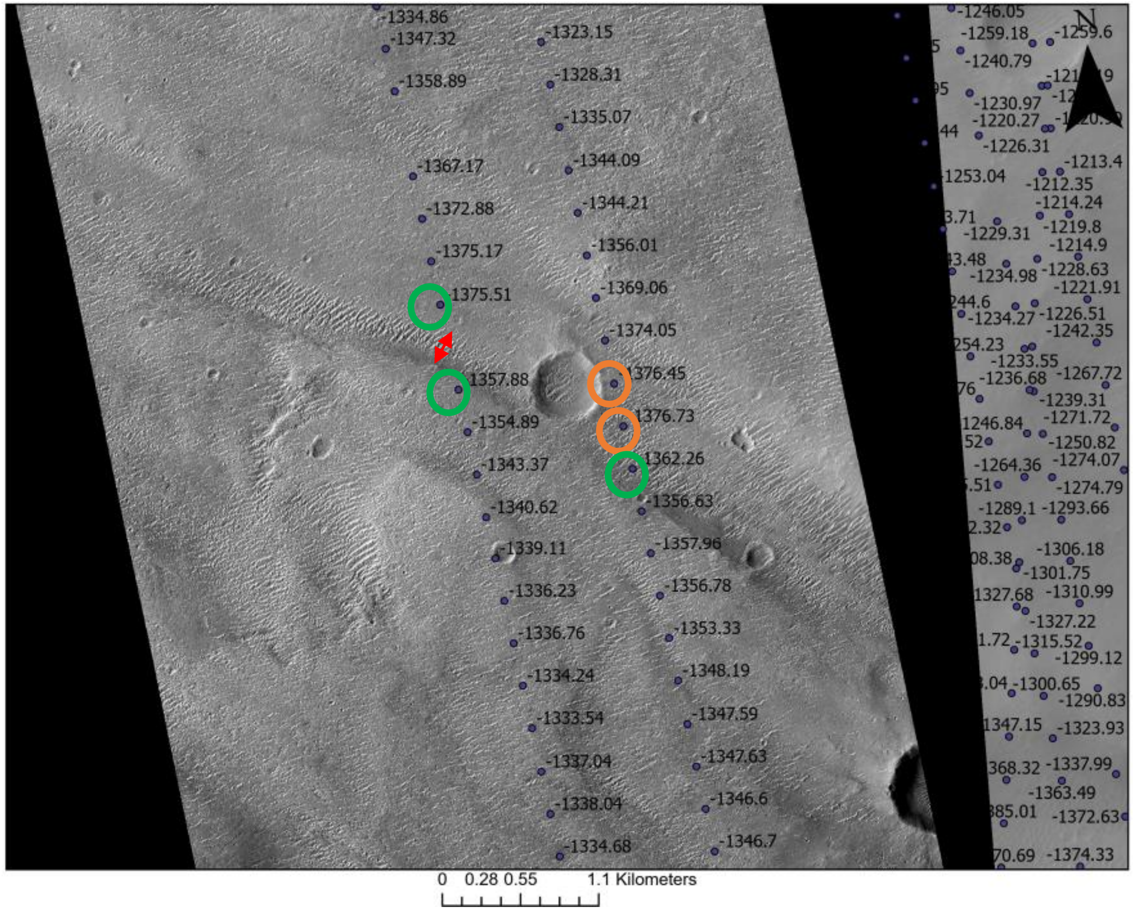
Channel width and depth



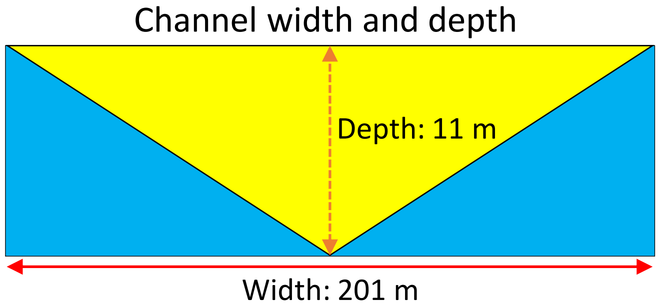
Cross Section 1	
Channel width, m	586
Average channel margin elevation (based on two MOLA shot points), m	-1365.66
Average channel floor elevation (based on three MOLA shot points), m	-1375.74
Average channel depth (margin-floor), m	10
Slope, m	4.96E-04
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	1.10E+04
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	1.07E+04
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	1.09E+04
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	1.15E+04
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	3.62E+03
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	3.31E+03
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	3.39E+03
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	3.79E+03

Average rectangular discharge, m^3/s = 1.10E+04
Average triangular discharge, m^3/s = 3.53E+03

Profile 2
ESP_073085_1595



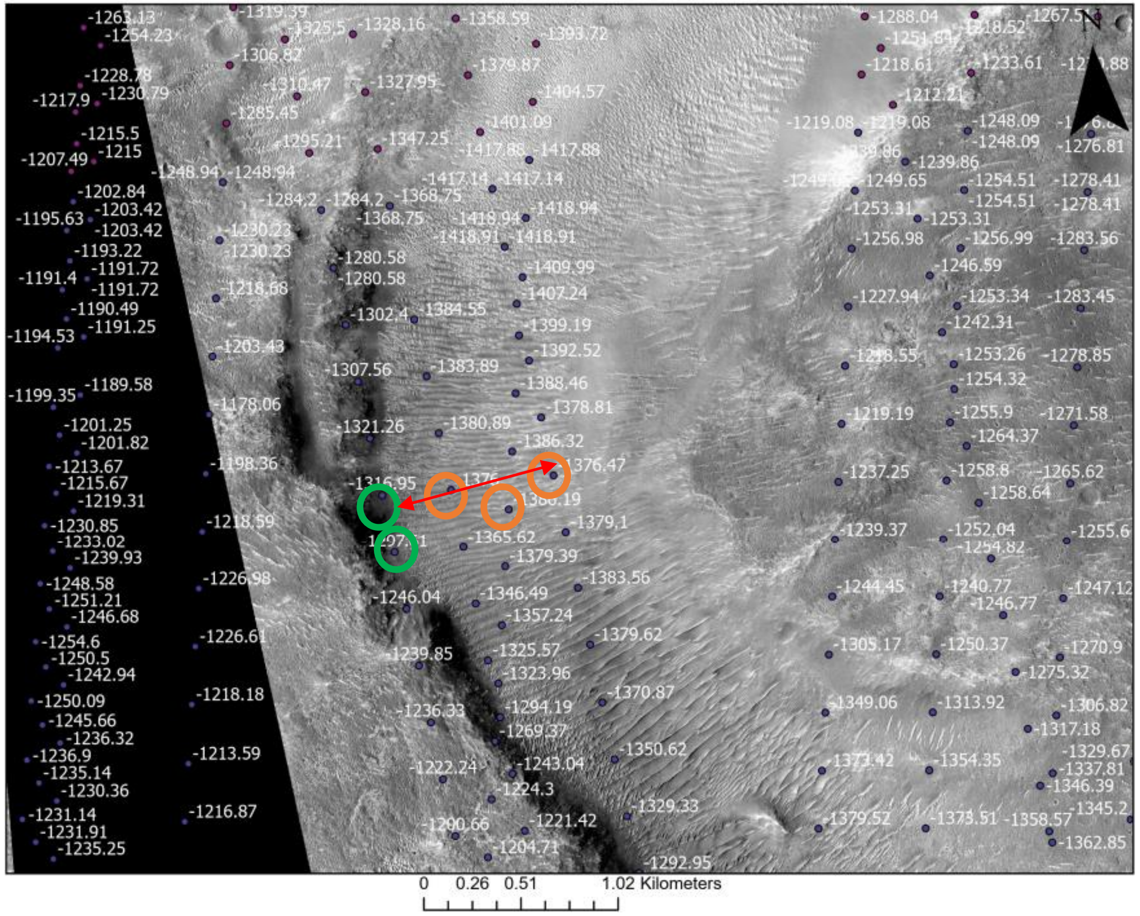
Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.



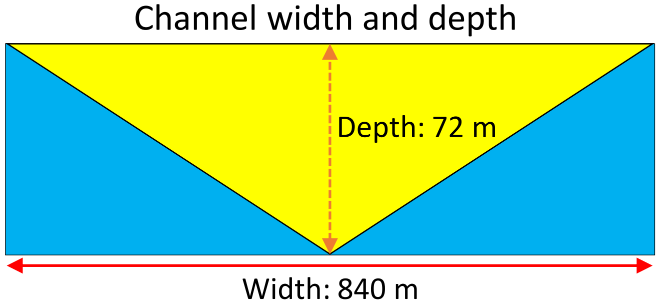
Cross Section 2	
Channel width, m	201
Average channel margin elevation (based on three MOLA shot points), m	-1365.22
Average channel floor elevation (based on two MOLA shot points), m	-1376.59
Average channel depth (margin-floor), m	11
Slope, m	4.96E-04
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	4.20E+03
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	4.11E+03
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	4.19E+03
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	4.40E+03
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	1.38E+03
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	1.27E+03
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	1.30E+03
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	1.45E+03

Average rectangular discharge, m^3/s = 4.23E+03
Average triangular discharge, m^3/s = 1.35E+03

Profile 3
ESP_074140_1605



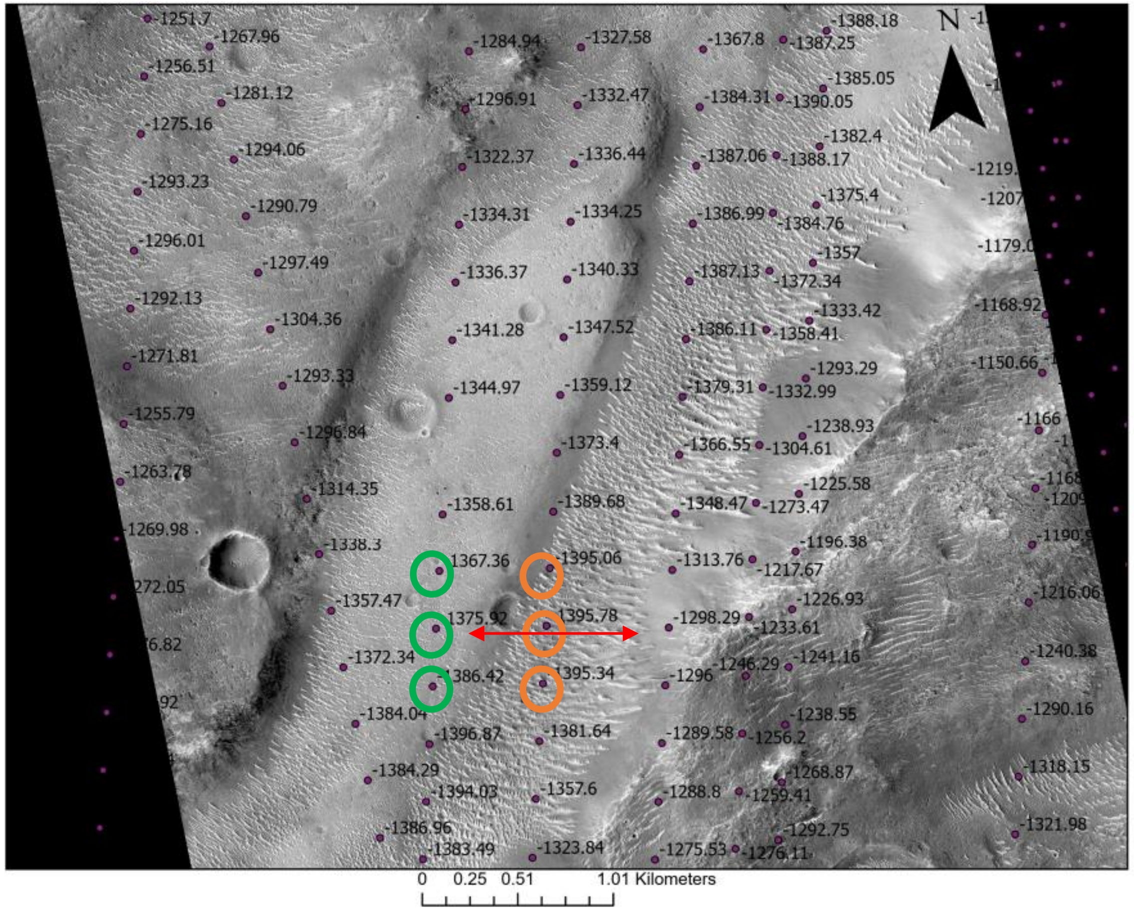
Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.



Cross Section 3	
Channel width, m	840
Average channel margin elevation (based on two MOLA shot points), m	-1307.28
Average channel floor elevation (based on three MOLA shot points), m	-1379.53
Average channel depth (margin-floor), m	72
Slope, m	4.21E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	1.00E+06
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	1.09E+06
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	1.10E+06
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	9.63E+05
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	3.30E+05
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	3.48E+05
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	3.52E+05
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	3.18E+05

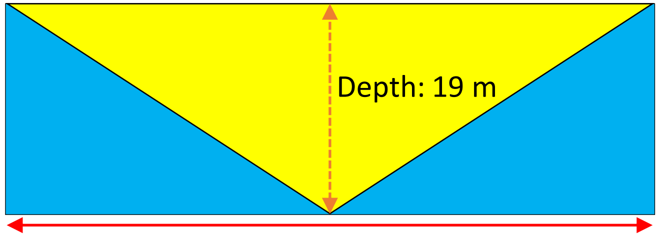
Average rectangular discharge, m^3/s = 1.04E+06
Average triangular discharge, m^3/s = 3.37E+05

Profile 4
ESP_075142_1605



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

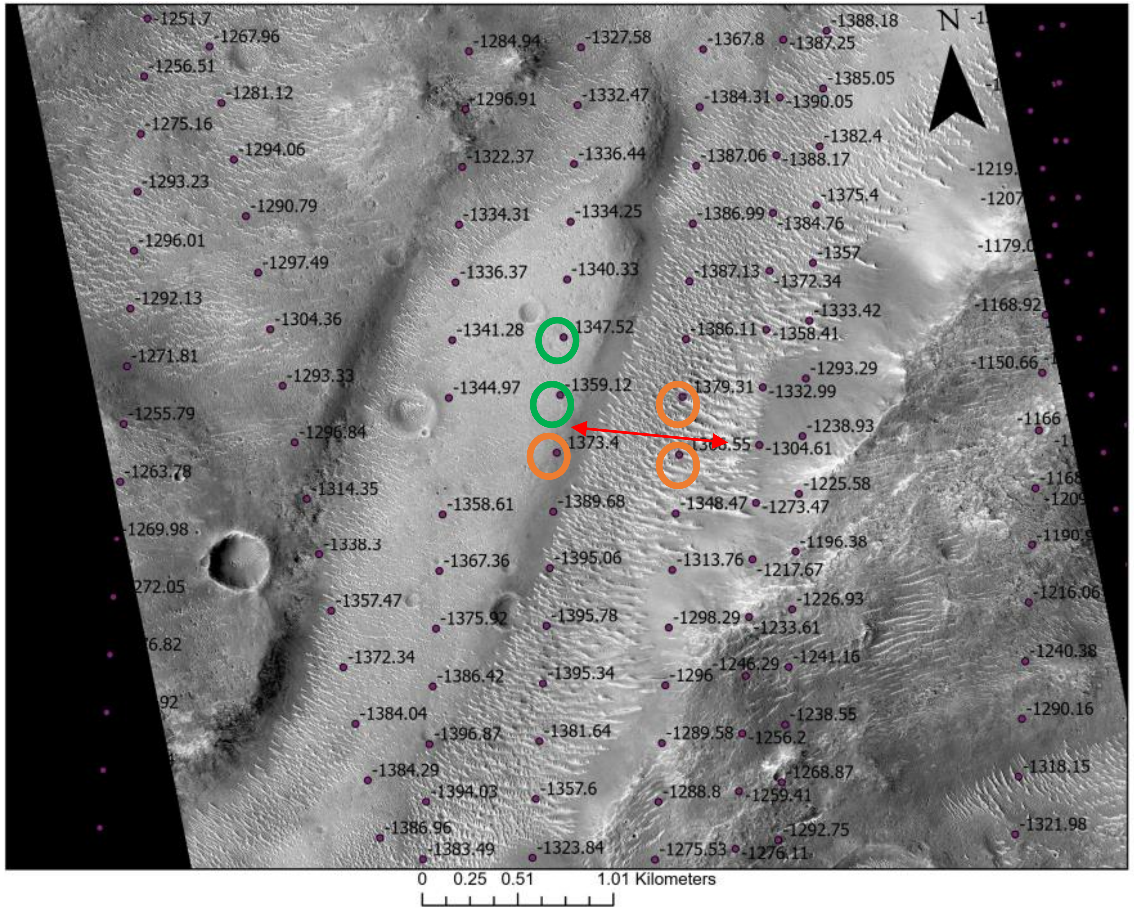
Channel width and depth



Cross Section 4	
Channel width, m	909
Average channel margin elevation (based on three MOLA shot points), m	-1376.57
Average channel floor elevation (based on three MOLA shot points), m	-1395.39
Average channel depth (margin-floor), m	19
Slope, m	3.23E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	1.21E+05
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	1.24E+05
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	1.25E+05
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	1.17E+05
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	3.98E+04
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	3.87E+04
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	3.95E+04
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	3.87E+04

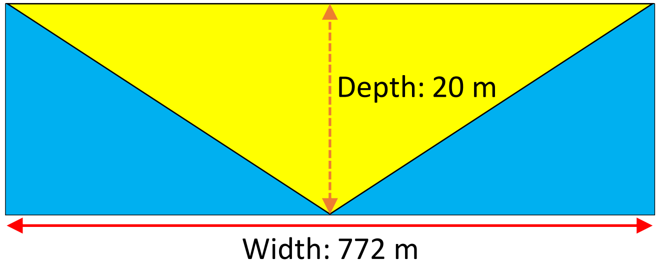
Average rectangular discharge, m^3/s = 1.22E+05
Average triangular discharge, m^3/s = 3.92E+04

Profile 5
ESP_075142_1605



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

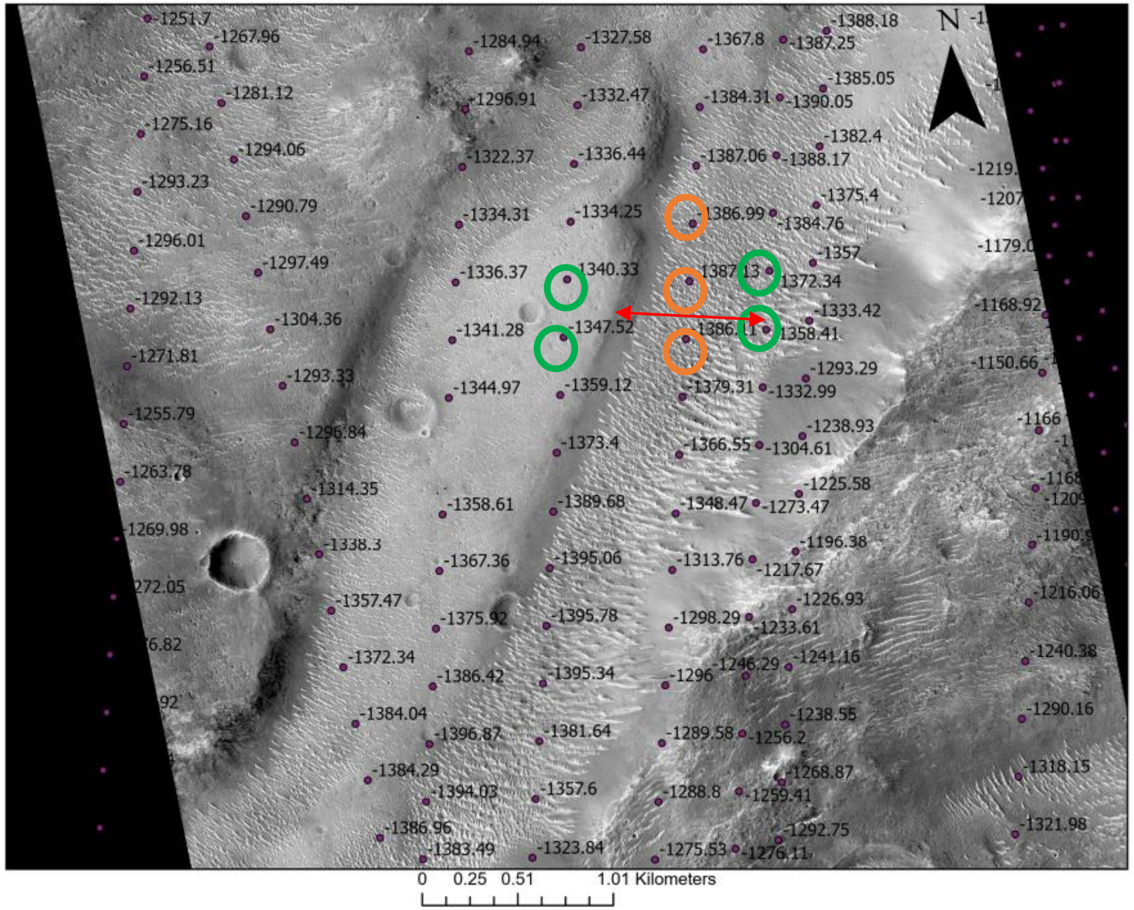
Channel width and depth



Cross Section 5	
Channel width, m	772
Average channel margin elevation (based on two MOLA shot points), m	-1353.32
Average channel floor elevation (based on three MOLA shot points), m	-1373.09
Average channel depth (margin-floor), m	20
Slope, m	3.23E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	1.11E+05
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	1.14E+05
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	1.15E+05
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	1.08E+05
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	3.65E+04
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	3.56E+04
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	3.63E+04
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	3.55E+04

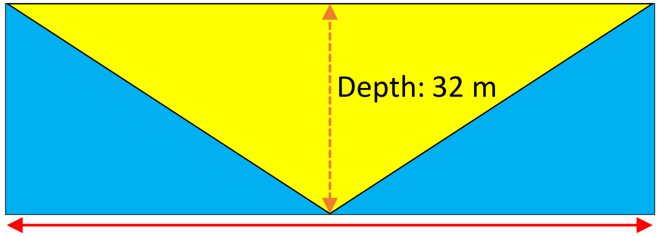
Average rectangular discharge, m^3/s = 1.12E+05
Average triangular discharge, m^3/s = 3.60E+04

Profile 6
ESP_075142_1605



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

Channel width and depth

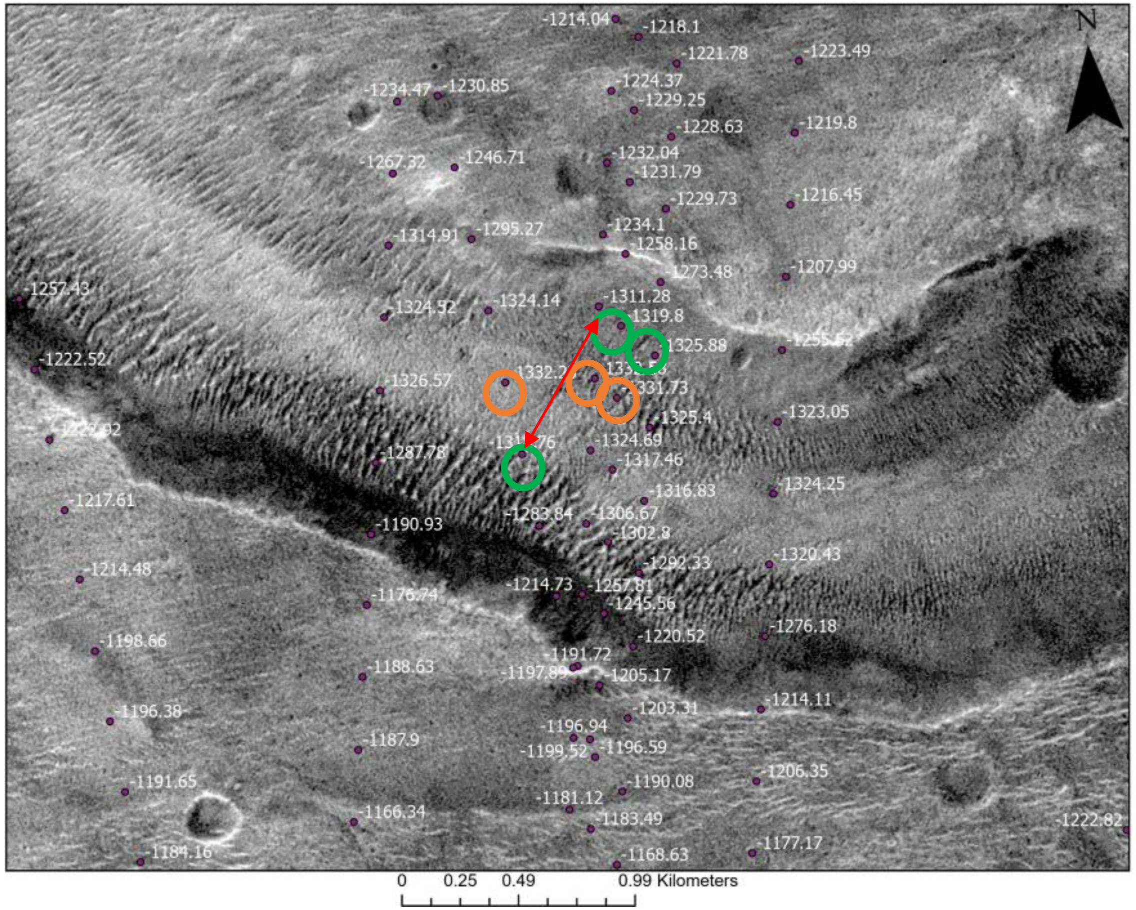


Width: 750 m

Cross Section 6	
Channel width, m	750
Average channel margin elevation (based on four MOLA shot points), m	-1354.65
Average channel floor elevation (based on three MOLA shot points), m	-1386.74
Average channel depth (margin-floor), m	32
Slope, m	3.23E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	2.24E+05
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	2.35E+05
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	2.38E+05
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	2.18E+05
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	7.38E+04
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	7.45E+04
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	7.57E+04
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	7.17E+04

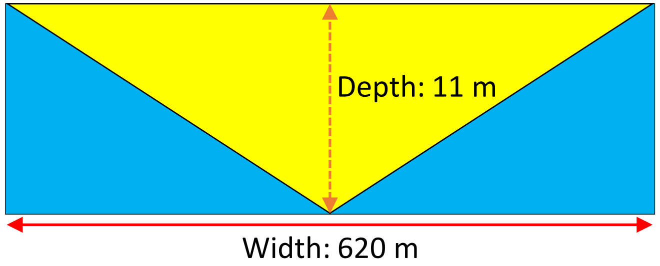
Average rectangular discharge, m^3/s = 2.29E+05
Average triangular discharge, m^3/s = 7.39E+04

Profile 7
F13_040987_1621_XI_17S021W (CTX)



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

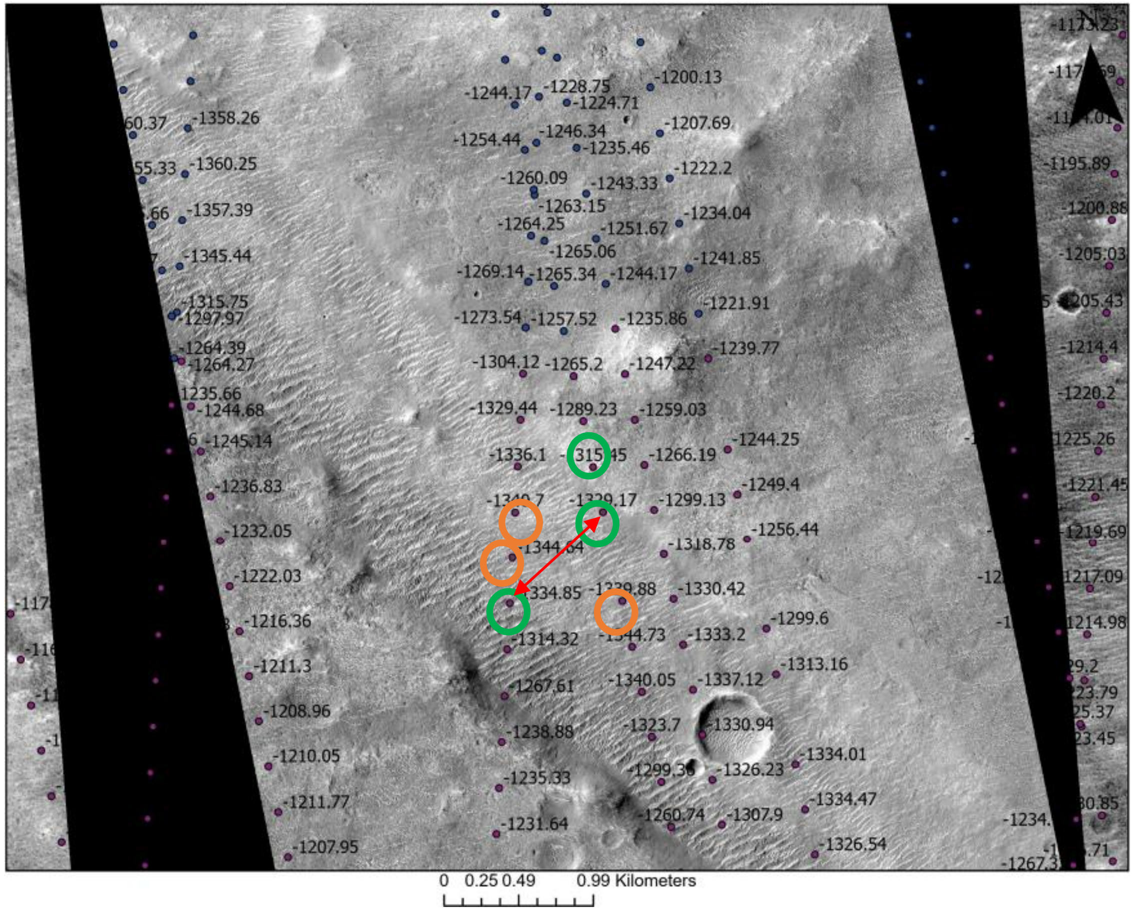
Channel width and depth



Cross Section 7	
Channel width, m	620
Average channel margin elevation (based on three MOLA shot points), m	-1321.48
Average channel floor elevation (based on three MOLA shot points), m	-1332.18
Average channel depth (margin-floor), m	11
Slope, m	3.99E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	3.83E+04
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	3.77E+04
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	3.84E+04
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	3.69E+04
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	1.26E+04
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	1.17E+04
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	1.20E+04
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	1.22E+04

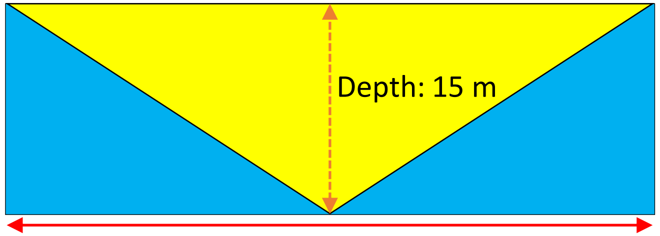
Average rectangular discharge, m^3/s = 3.78E+04
Average triangular discharge, m^3/s = 1.21E+04

Profile 8
ESP_076619_1605



Individual shot points used to estimate average channel margin elevation are circled in green with MOLA elevations shown. Channel floor elevation derived by averaging shot points circled in orange with MOLA elevations shown.

Channel width and depth



Cross Section 8	
Channel width, m	620
Average channel margin elevation (based on three MOLA shot points), m	-1326.49
Average channel floor elevation (based on three MOLA shot points), m	-1341.74
Average channel depth (margin-floor), m	15
Slope, m	3.99E-03
Discharge hydraulic radius rectangle friction factor sand (eq 5), m^3/s	6.24E+04
Discharge hydraulic radius rectangle friction factor gravel (eq 6), m^3/s	6.29E+04
Discharge hydraulic radius rectangle friction factor boulder (eq 7), m^3/s	6.39E+04
Discharge hydraulic radius rectangle friction factor upper regime (eq 8), m^3/s	6.02E+04
Discharge hydraulic radius triangle friction factor sand (eq 5), m^3/s	2.06E+04
Discharge hydraulic radius triangle friction factor gravel (eq 6), m^3/s	1.96E+04
Discharge hydraulic radius triangle friction factor boulder (eq 7), m^3/s	2.00E+04
Discharge hydraulic radius triangle friction factor upper regime (eq 8), m^3/s	1.99E+04

Average rectangular discharge, m^3/s = 6.24E+04
Average triangular discharge, m^3/s = 2.00E+04